

## CLAIM

1. An encoding method for performing variable length encoding by using correspondence data on non-0  
5 coefficient quantity data indicating a quantity of non-0 transformation coefficients in a plurality of transformation coefficients obtained by performing orthogonal transformation on image block data, comprising:
- 10 when, for respective possible values of said non-0 coefficient quantity data in the image block data having a first block size, using a plurality of correspondence data each regulating correspondence of the non-0 coefficient quantity data to the encoding code, so that  
15 bit lengths of non-0 coefficient quantity data indicating "0" become different from one another, and the maximum bit length of said encoding codes to be used by the correspondence data becomes longer as the bit lengths of the non-0 coefficient quantity data indicating "0"  
20 becomes shorter,
- a first step for assigning a plurality of transformation coefficients obtained by performing orthogonal transformation on image block data having a second block size, which is a multiple of said first  
25 block size, to one sub block data in accordance with a

frequency corresponding to the transformation coefficients among a plurality of sub block data composed of said transformation coefficients by the same number as that in image block data having said first block size;

5           a second step for generating said non-0 coefficient quantity data for each of said plurality of sub block data based on said transformation coefficients assigned to the sub block data in said first step; and

          a third step for determining said encoding codes to  
10 be assigned to said non-0 coefficient quantity data generated in said second step for each of said plurality of sub block data by using said correspondence data in which an encoding code having a shorter bit length is assigned to said non-0 coefficient quantity data  
15 indicating "0" comparing with said correspondence data used for other sub block data on the direct current component side with respect to the sub block data.

2.       An encoding method as set forth in claim 1, wherein said first step uses said plurality of sub block  
20 data regulated to be in accordance with frequencies in a plurality of sub blocks obtained by dividing a vertically and horizontally two-dimensional frequency region..

3.       An encoding method as set froth in claim 1, further comprising:

25           a fourth step for generating said non-0 coefficient

quantity data of the image block data based on a plurality of transformation coefficients obtained by performing orthogonal transformation on said image block data having said first block size;

5           a fifth step for specifying a quantity of transformation coefficients other than "0" and "1" as an absolute value in said transformation coefficients of other image block data related to display positions around a display position related to said image block data having said first block size, and selecting said  
10           correspondence data, wherein said non-0 coefficient quantity data and an encoding code having a shorter bit length are related, as the specified quantity becomes smaller; and

15           a sixth step for determining said encoding code of said non-0 coefficient quantity data of said image block data having said first block size by using the correspondence data selected in said fifth step.

4.       An encoding method as set forth in claim 3,  
20       wherein:

          said first, second and third steps are executed when said orthogonal transformation is performed in units of image block data having said second block size; and

          said fourth, fifth and sixth steps are executed  
25       when said orthogonal transformation is performed in units

of image block data having said first block size.

5. An encoding method as set forth in claim 1,  
wherein:

when said first block size is  $N \times N$  ( $N$  is an integer)  
5 and said second block size is  $2N \times 2N$ ,  
said first step scans the transformation  
coefficients of said image data having said second block  
size successively from a transformation coefficient  
corresponding to a frequency close to direct current  
10 components, and generates first sub block data composed  
of transformation components scanned first to  $N^2$ -th,  
second sub block data composed of transformation  
components scanned  $(N^2+1)$ -th to  $2N^2$ -th, third sub block  
data composed of transformation components scanned  
15  $(2N^2+1)$ -th to  $3N^2$ -th, and fourth sub block data composed  
of transformation components scanned  $(3N^2+1)$ -th to  $4N^2$ -  
th; and

said third step determines said encoding code of  
said non-0 coefficient quantity data of said first sub  
20 block data by using said correspondence data, wherein a  
bit length of said encoding code to be assigned to said  
non-0 coefficient quantity data indicating "0" is longer  
comparing with that in said correspondence data used for  
encoding said non-0 coefficient quantity data of said  
25 second and third sub block data generated in said second

step, and determines said encoding code of said non-0 coefficient quantity data of said fourth sub block data by using said correspondence data, wherein a bit length of said encoding code to be assigned to said non-0

5 coefficient quantity data indicating "0" is shorter comparing with that in said correspondence data used for encoding said non-0 coefficient quantity data of said second and third sub block data generated in said second step.

10 6. An encoding method as set forth in claim 1, wherein:

said correspondence data

regulates said encoding code to be assigned to a set of final continuing quantity data of transformation coefficients of "1" as an absolute value  
15 continuing at the end of a series of said transformation coefficients obtained by performing orthogonal transformation on said block data and said non-0 coefficient quantity data; and

20 regulates a bit length of said encoding code to be the same or longer as said final continuing quantity data becomes larger for a plurality of sets, wherein said final continuing quantity data is different but said non-0 coefficient quantity data is the same.

25 7. An encoding apparatus for performing variable

length encoding by using correspondence data on non-0  
coefficient quantity data indicating a quantity of non-0  
transformation coefficients in a plurality of  
transformation coefficients obtained by performing  
5 orthogonal transformation on image block data,  
comprising:

when, for respective possible values of said non-0  
coefficient quantity data in the image block data having  
a first block size, using a plurality of correspondence  
10 data each regulating correspondence of the non-0  
coefficient quantity data to the encoding code, so that  
bit lengths of non-0 coefficient quantity data indicating  
"0" become different from one another, and the maximum  
bit length of said encoding codes to be used by the  
15 correspondence data becomes longer as the bit lengths of  
the non-0 coefficient quantity data indicating "0"  
becomes shorter,

an assigning means for assigning a plurality of  
transformation coefficients obtained by performing  
20 orthogonal transformation on image block data having a  
second block size, which is a multiple of said first  
block size, to one sub block data in accordance with a  
frequency corresponding to the transformation  
coefficients among a plurality of sub block data composed  
25 of said transformation coefficients by the same number as

that in image block data having said first block size;

a generating means for generating said non-0  
coefficient quantity data for each of said plurality of  
sub block data based on said transformation coefficients  
5 assigned to the sub block data by said assigning means;  
and

an encoding means for determining said encoding  
codes to be assigned to said non-0 coefficient quantity  
data generated by said generation means for each of said  
10 plurality of sub block data by using said correspondence  
data in which an encoding code having a shorter bit  
length is assigned to said non-0 coefficient quantity  
data indicating "0" comparing with said correspondence  
data used for other sub block data on the direct current  
15 component side with respect to the sub block data.

8. An encoding apparatus as set forth in claim 7,  
further including:

a differential generating means for generating  
differential image data of image data to be encoded and  
20 the prediction image data; and

an orthogonally transforming means for performing  
said orthogonal transformation on said differential image  
data generated by said differential generating means in  
units of image block data having said first block size or  
25 said second block size,

wherein said assigning means performs said  
assigning on said plurality of transformation  
coefficients obtained by performing orthogonal  
transformation on the image block data having said second  
5 block size by said orthogonally transforming means.

9. A program to be executed by a computer to  
perform encoding processing of variable length encoding  
by using correspondence data on non-0 coefficient  
quantity data indicating a quantity of non-0  
10 transformation coefficients in a plurality of  
transformation coefficients obtained by performing  
orthogonal transformation on image block data, by which:

when, for respective possible values of said non-0  
coefficient quantity data in the image block data having  
15 a first block size, using a plurality of correspondence  
data each regulating correspondence of the non-0  
coefficient quantity data to the encoding code, so that  
bit lengths of non-0 coefficient quantity data indicating  
"0" become different from one another, and the maximum  
20 bit length of said encoding codes to be used by the  
correspondence data becomes longer as the bit lengths of  
the non-0 coefficient quantity data indicating "0"  
becomes shorter,

a first procedure for assigning a plurality of  
25 transformation coefficients obtained by performing

orthogonal transformation on image block data having a second block size, which is a multiple of said first block size, to one sub block data in accordance with a frequency corresponding to the transformation

5 coefficients among a plurality of sub block data composed of said transformation coefficients by the same number as that in image block data having said first block size;

a second procedure for generating said non-0 coefficient quantity data for each of said plurality of sub block data based on said transformation coefficients assigned to the sub block data in said first procedure; and

a third procedure for determining said encoding codes to be assigned to said non-0 coefficient quantity data generated in said second procedure for each of said plurality of sub block data by using said correspondence data in which an encoding code having a shorter bit length is assigned to said non-0 coefficient quantity data indicating "0" comparing with said correspondence data used for other sub block data on the direct current component side with respect to the sub block data

are executed by said computer.

10. A decoding method, for assigning transformation coefficients obtained by performing orthogonal transformation on image data to be encoded in

units of block data having a second block size, which is a multiple of a first block size, to a plurality of sub block data in accordance with frequencies related to the transformation coefficients; generating non-0 coefficient  
5 quantity data indicating a quantity of non-0 transformation coefficients in transformation coefficients composing the sub block data for each of said plurality of sub block data; and, when an encoding code of said non-0 coefficient quantity data is obtained  
10 by using predetermined correspondence data, retrieving said non-0 coefficient quantity data from said encoding code by using said correspondence data, including:

when, for respective possible values of said non-0 coefficient quantity data in the image block data having  
15 a first block size, using a plurality of correspondence data each regulating correspondence of the non-0 coefficient quantity data to the encoding code, so that bit lengths of non-0 coefficient quantity data indicating "0" become different from one another, and the maximum  
20 bit length of said encoding codes to be used by the correspondence data becomes longer as the bit lengths of the non-0 coefficient quantity data indicating "0" becomes shorter,

a first step for determining said non-0 coefficient  
25 quantity data of each of said encoding codes of said

plurality of sub block data by using said correspondence data, wherein an encoding code having a longer bit length comparing with that in said correspondence data used for said sub block data on the direct current component side and said non-0 coefficient quantity data indicating "0" are related for the sub block data;

a second step for generating said transformation coefficients composing the sub block data based on said non-0 coefficient quantity data determined in said first step for each of said plurality of sub block data; and

a third step for relocating said transformation coefficients generated in said second step and obtaining transformation coefficients of said block data having said second block size.

11. A decoding method as set forth in claim 10, including:

when decoding said encoding codes of said non-0 coefficient quantity data of transformation coefficients obtained by performing orthogonal transformation on image data to be encoded in units of block data having a first block size,

a fourth step for specifying a quantity of transformation coefficients other than "0" and "1" as an absolute value in said transformation coefficients of other image block data related to display positions

around a display position related to said image block data having said first block size;

a fifth step for selecting said correspondence data, wherein said non-0 coefficient quantity data and an  
5 encoding code having a shorter bit length are related, as the quantity specified in said fourth step becomes smaller;

a sixth step for determining said non-0 coefficient quantity data corresponding to said encoding code of said  
10 image block data having said first block size by using the correspondence data selected in said fifth step; and

a seventh step for generating said transformation coefficients of said block data having said first block size based on said non-0 coefficient quantity data  
15 determined in said sixth step.

12. A decoding method as set forth in claim 11, wherein:

said fourth, fifth, sixth and seventh steps are executed when said first block size is instructed; and

20 said first, second and third steps are executed when said second block size is instructed.

13. A decoding apparatus, for assigning transformation coefficients obtained by performing orthogonal transformation on image data to be encoded in  
25 units of block data having a second block size, which is

a multiple of a first block size, to a plurality of sub block data in accordance with frequencies corresponding to the transformation coefficients; generating non-0 coefficient quantity data indicating a quantity of non-0 transformation coefficients in transformation coefficients composing the sub block data for each of said plurality of sub block data; and, when an encoding code of said non-0 coefficient quantity data is obtained by using predetermined correspondence data, retrieving said non-0 coefficient quantity data from said encoding code by using said correspondence data, including:

when, for respective possible values of said non-0 coefficient quantity data in the image block data having a first block size, using a plurality of correspondence data each regulating correspondence of the non-0 coefficient quantity data to the encoding code, so that bit lengths of non-0 coefficient quantity data indicating "0" become different from one another, and the maximum bit length of said encoding codes to be used by the correspondence data becomes longer as the bit lengths of the non-0 coefficient quantity data indicating "0" becomes shorter,

a determining means for determining said non-0 coefficient quantity data of each of said encoding codes of said plurality of sub block data by using said

correspondence data, wherein an encoding code having a longer bit length comparing with that in said correspondence data used for said sub block data on the direct current component side and said non-0 coefficient quantity data indicating "0" are related for the sub block data as the bit lengths of non-0 coefficients quantity data indicating "0" becomes shorter;

a generating means for generating said transformation coefficients composing the sub block data based on said non-0 coefficient quantity data determined in said determining means for each of said plurality of sub block data; and

a retrieving means for relocating said transformation coefficients generated by said generating means and obtaining transformation coefficients of said block data having said second block size.

14. A program to be executed by a computer, for assigning transformation coefficients obtained by performing orthogonal transformation on image data to be encoded in units of block data having a second block size, which is a multiple of a first block size, to a plurality of sub block data in accordance with frequencies related to the transformation coefficients; generating non-0 coefficient quantity data indicating a quantity of non-0 transformation coefficients in transformation

coefficients composing the sub block data for each of  
said plurality of sub block data; and, when an encoding  
code of said non-0 coefficient quantity data is obtained  
by using predetermined correspondence data, retrieving  
5 said non-0 coefficient quantity data from said encoding  
code by using said correspondence data, by which:

when, for respective possible values of said non-0  
coefficient quantity data in the image block data having  
a first block size, using a plurality of correspondence  
10 data each regulating correspondence of the non-0  
coefficient quantity data to the encoding code, so that  
bit lengths of non-0 coefficient quantity data indicating  
"0" become different from one another, and the maximum  
bit length of said encoding codes to be used by the  
15 correspondence data becomes longer as the bit lengths of  
the non-0 coefficient quantity data indicating "0"  
becomes shorter,

a first procedure for determining said non-0  
coefficient quantity data of each of said encoding codes  
20 of said plurality of sub block data by using said  
correspondence data, wherein an encoding code having a  
longer bit length comparing with that in said  
correspondence data used for said sub block data on the  
direct current component side and said non-0 coefficient  
25 quantity data indicating "0" are related for the sub

block data;

a second procedure for generating said transformation coefficients composing the sub block data based on said non-0 coefficient quantity data determined  
5 in said first procedure for each of said plurality of sub block data; and

a third procedure for relocating said transformation coefficients generated in said second procedure and obtaining transformation coefficients of  
10 said block data having said second block size  
are executed by said computer.